AN INVESTIGATION OF THE SPONTANEOUS ALTERNATION BEHAVIOUR OF DOWN'S SYNDROME CHILDREN ON TASKS OF VARYING DISCRIMINABILITY

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ABSTRACT

Thirty Down's Syndrome children and thirty preschoolers were used to investigate the effects of tasks of varying discriminability on spontaneous alternation behaviour. The experimental design was a 3 x 3 x 2 factorial arrangement of repeated measures with Conditions X Sex X Group as the three factors. Results revealed both groups alternated above chance but the discriminability only affected the preschoolers while the Down's Syndrome children showed little variability in their performance. It was postulated that although both groups had a choice-sequence preference of alternation, Down's Syndromes were merely alternating invariantly whereas the preschoolers were affected more by characteristics of the particular conditions.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

1. General Introduction

Alternation behaviour has been the focal point of a considerable amount of hypothesis formulation and research in psychology since first Tolman in 1925, and then Dennis (1935) described the phenomenon.

What is alternation behaviour? Using Dember's (1961) definition - "if there are two alternative behaviours, right and left, and two trials, on each of which either behaviour can occur, then four behaviour patterns are possible. Two of these patterns will be repetitions - right-right and left-left - and two will be alternations - right-left and left-right. If the two alternatives are equally likely to occur, and if the behaviour on the second trial is independent of the first then the probability of alternation is 2/4 or .50". In practice, then, alternation is said to have occurred only if it occurs with a probability significantly greater than .50. Thus, in order to see if any significant behaviour occurs, alternation must be studied either with large groups of subjects, or with several tests on the same, relatively few subjects. The latter of these procedures will be adopted in this study.

Hull (1943) attributed spontaneous alternation to the action of response-produced inhibition (I_R) whereas Glanzer attributed it to stimulus satiation (I_S). Both were peripheralistic theories of avoidance behaviours; with I_R emphasizing the output end of the behavioural system and I_S stressing the input end. Dember and Earl (1957) presented a third account of alternation, attributing the behaviour to the organism optimizing stimulus change, an approach behaviour, while Walker (1958) proposed an 'action decrement' (I_C) theory wherein any psychological action is followed by a lowered capacity for rearousal of the same event. Both this and the former theory were essentially centralistic in focus as compared to the previous two formulates.

Thompson (1960) regarded alternation as a special case of exploratory behaviour based on curiosity drive and Berlyne (1960) suggested that curiosity is behaviour initiated by the activating properties of a novel stimulus. Other approaches to alternation include Estes and Schoeffler's (1955) formulation that alternation is an acquired strategy - a learned general mode of responding; and the view that alternation represents avoidance of a previous event resulting from punishment or frustration associated with that event. However, neither of these last two explanations have as general an application as the previously noted propositions.

There is considerable predictive overlap among these various theories and it is difficult to generate differential predictions from them. For any one both supportive and critical evidence can be cited and, although animal investigations can be found which justify their claims of one theory's supremacy over another with substantial research, as yet there are few studies comparing theories at the human level. Thus, in both animal and human research, due to both theoretical conflict and/or methodological difficulties, the question as to why alternation behaviour occurs remains to some extent unresolved.

Since Tolman's and Dennis' early observations on the alternation behaviour of rats there has been a steady output of research on alternation, for the most part using rats as subjects though there are several experiments that demonstrate spontaneous alternation behaviour in other animals, including man.

Alternation has been observed at the infrarodent level in paramecia (Lepley and Rice, 1952), the cockroach (Iwahara and Soeda, 1957) and the earthworm (Wayner and Zellner, 1958); Miles (1958) reported response alternation in kittens, and Kirkby and Lackley (1968) observed spontaneous alternation behaviour in hamsters.

Of the numerous 'rat' studies there are those which merely demonstrate the existence of alternation tendencies, e.g., Dasheill, 1930; Montgomery, 1952; Glanzer, 1953b; Kivy, Earl and Walker, 1956; Sutherland, 1957; Douglas, 1966) and those in which different experimental variables have been demonstrated, such as daily trial duration (Wingfield and Dennis, 1935); the intertrial interval (Walker, 1956); amount of work involved in making alternation responses (Walker, Dember, Earl, Fawl and Karoly, 1955); similarity between alternatives (Dember and Roberts, 1958); novelty of stimuli (Dember, 1956; Denny, 1957); complexity of stimuli (Berlyne and Slater, 1957); free and forced repetition of response (Zeaman and Angell, 1953; Sutherland, 1957); varying reinforcement (Thompson, 1960); age (Hughes, 1968a).

Other than the two cited, there seems to be little relevant data for species between rat and man, though one study by Schusterman, (1963) compared the strategies in two-choice situations of children and chimpanzees and found similar strategies of alternation used by both. However, the occurrence of the alternation pattern in man is fairly well documented despite difficulties such as devising a parallel to the animal maze situation. Relevant examples are such studies as Wingfield, (1943); Iwahara (1959); Bakan, (1960); Lawless and Engstrand, (1960); Ellis and Arnoult, (1965); Schultz, (1964); Rieber, (1966) and Pate and Bell (1971).

In these studies mainly children have been used as subjects, although in some cases their performances have been compared with adults or college students. (Strain, 1963; Weir, 1964). As in the animal studies, a number of different variables have been investigated as affecting alternation behaviour. One study by Peters and Penney, (1964) compared the T maze tracing patterns of high and low reactively curious children and found alternation a function of the children's curiosity level and stimulus variability, a finding consistent with other studies (Ellis and Arnoult, 1965; Mendel, 1965; and Hutt, 1966). Stimulus complexity research by Iwahara and Sugimura (1959), May (1963) and Cantor (1963) similarly found this.

Alternation behaviour has been investigated as a means of studying decision-making and other thought processes. Response tendencies have been recorded in binary-choice conditions in attempt to extrapolate from them possible cognitive processes behind action taken, as for example, Ellis and Arnoult (1965), who concluded from their study that alternation was related to activating properties of the stimuli in accordance with Berlyne's theory of stimulus novelty; and Jeffrey and Cohen (1965), who attributed alternation as being due to immaturity in centration processes.

Many researchers have studied alternation behaviour in connection with learning, as part of research into learning sets, for example, Ellis, Girardeau and Pryer (1962); House and Zeaman (1963); Archer (1962); Bourne (1957). Evidence has been gathered for children and adults, and recent research has demonstrated not only the existence of learning sets but also that two-choice discrimination learning is influenced by the presence of irrelevant stimulus dimensions, initial response outcome and developmental level of the pertinent task response.

From work on Mead's and Piaget's theories of social and cognitive development, Gratch (1964) postulated that alternation behaviour shifts with age. Research showed that children up to six years of age alternated in choosing between two packs of cards whereas adolescents alternated very irregularly. This had also been found in the earlier work of Piaget and Inhelder (1956) and was further confirmed by Kessen and Kessen (1961), Stephenson and Weir (1961), Rieber (1966) and Weir (1964).

Other studies have included age as one of several variables investigated. Miller, Tu, Manley and Moffat (1969) looked into children's response alternation as a function of stimulus duration, age and trials. Then a year later Manley and Miller, in addition to confirming findings on age levels, established response duration as a further variable affecting alternation behaviour. These compounded studies are typical of later work in the field which seems to undertake the simultaneous investigation of several variables affecting alternation and choice behaviour. Croll's (1966) study investigating stimulus duration, intertrial interval and trials duration is an example of this.

In general, evidence to date shows that not only do both humans and rats exhibit alternation behaviour, but also there will be a decrease in alternation: where considerable amounts of effort are necessary by subjects to enable alternation of responses; by successive free trials, and with increasing age. Highly similar responses also yield less alternation than two dissimilar. On the other hand, alternation increases with short intertrial intervals; with forced repetition of responses; and with higher degrees of discrimination between stimuli or conditions. In relation to this, subjects prefer the more complex and more novel stimuli when exposed to two alternatives differing in either of these dimensions. The last experimental variable mentioned, of varying discrimination between conditions, will be manipulated in the present study.

From these results, alternation behaviour emerges as providing a rich source of insight into the behaviour of organisms, into the motivational processes underlying many more complex behavioural phenomena, and as indicating research into other processes such as perception (e.g. Dember and Millbrook, 1956); learning (Girardeau, 1959); memory (Dember, Brodwick and Robert, 1960); attention (Crosby, 1972). Clinton and Evans (1971) also considered alternation in connection with learning processes. They believe that educators may profit from consideration of alternation as one of the response tendencies which may compete with (or be used to facilitate) classroom learning and performance. In their study they applied this to an educable mentally retarded population in a psychopaedic hospital.

It is unfortunate that, in general, this population has had little research carried out on it as regards alternation studies, as such research could be of value in the light of information already gained to date from rat and human studies. Therefore a subnormal population, Down's Syndrome children, will be used as experimental group in this study.

Of the work done in this area there are no available studies specifically on the alternation behaviour of Down's Syndrome children. Those studies available have used a representative group of mental retardates, usually equated with normal controls on mental age. However, in any differences found in these studies, consideration must be given to other characteristics of retarded subjects associated with their individual and atypical social experiences and environmental histories e.g. diagnosis, length of institutionalization, epilepsy, medication, prognosis. Failure to consider such characteristics restricts the types of interpretation and generalizations that can be made from experimental work.

Queries on the relationship between age and alternation have also arisen in this area and Gerjuoy and Gerjuoy (1964, 65) have findings consistent with those previously mentioned on normal subjects, that alternation decreases with increasing mental age. A later study by Gerjuoy, Winters and Hoats (1966) substantiated this and extended investigations further to find that retardates alternate more than normal controls. They suggest this is due to a more primitive form of problem-solving operating in retardates than is used by normals when confronted with the same task.

Several studies have investigated the cognitive processes of retardates in choice situations (e.g. O'Connor and Hermelin, 1961; Ellis, Girardeau and Pryer, 1962; House and Zeaman, 1963; Eimas, 1964; Balla and Zigler, 1964; Gerjuoy and Winters, 1968; and Whitman, 1971). In general these maintain that retardates do not differ in their cognitive processes from normals of the same mental age but cortical changes are slower to take place than in normals, hence retardates are slower to process information and function at a different rate than the normal controls. Despite this, Eimas has found that retardates are quite able to utilize a considerable amount of provided stimulus information. This finding is in keeping with studies by Plenderleith (1956), Stevenson and Zigler (1957), O'Connor and Hermelin (1961) and Kass and Stevenson (1961) in which no differences occurred in learning rates in two-choice discrimination problems between groups of retardates and normal subjects of comparable mental age. It is also consistent with Zeaman and House (1962) who found retardates were of equal strength in discrimination learning as normals. Maggs (1974) adds that often retardates must be taught to attend to the relevant stimuli before discrimination learning is possible, substantiating Scott's (1966) premise that it is the "starting to learn" that is difficult for retardates, not learning in itself. Whitman, in his study, found his institutionalized subjects were more accurate in discriminations than normals although this could be due to the fact his experimental group were not naive as subjects, having previously been involved in research.

2. Nature and scope of the investigation

It is the purpose of this study to investigate the spontaneous alternation behaviour of Down's Syndrome children and preschoolers with objects of varying discriminability, using a repeated measures design.

On the basis of research previously discussed it is hypothesized that subjects will alternate in their choices of stimuli and this will be a decreasing function of discriminability i.e. alternation will decrease as discrimination between stimuli becomes more difficult.

Repeated measures, exposing the same relatively few subjects to different conditions, was chosen as the experimental design due to the limited number of subjects available. It was decided to limit the study to manipulating the one independent variable, discrimination, in order to observe directly the relationship between it and spontaneous alternation behaviour. Other similar studies have manipulated several variables simultaneously, such as intertrial intervals, age, stimulus duration, stimulus complexity, familiarization with stimuli and sex (e.g. Croll, 1966; Manley and Miller, 1968; Miller, Ia, Manley and Moffat, 1969; Peterson, 1970; Van den Broeke, 1975).

Results from research by Strain, Unikel and Adams (1969); Peterson (1970), and Van den Broeke (1975) have indicated that sex may influence results. It was initially considered, therefore, as a potential influence on alternation behaviour. However, as will be discussed, this was later disregarded as it was found not to have any effect on results in any way.

The mentally retarded population represents a great variety of syndromes, disorders and defects and all with vastly different backgrounds. As previously noted, any research using such subjects requires special consideration of these points. Consequently, it was decided to use Down's Syndrome children as subjects because of their relative homogeneity as a group from the standpoint of physical and intellectual characteristics, and their prevalence in trainable classes and other special education facilities.

However, amongst this group there are distinct differences pertaining to the three basic types of Down's Syndrome - trisomy-21, translocations and mosaics:

The 21-trisomics are the classic case of mongolism and are due to the presence of an extra chromosome in the ovum. This means that instead of having 46 chromosomes the child has a set of 47, with three where the twenty-first pair should be. This occurs during meiosis when a chromosome pair fails to separate; thus the germ cell has twenty-four instead of twenty-three chromosomes due to non-dysjunction of this cell. Trisomy-21 is often related to maternal age. Not all Down's Syndrome children have 47 chromosomes however, some have 46, with excess of chromosome twenty-one attached to other chromosomes, usually at the fifteenth pair but sometimes at the thirteenth, fourteenth, twentieth or twenty-first. This is called translocation and is related to heredity rather than age.

Mosaicism constitutes the third type of Down's Syndrome. This is not an abnormality in the germ cell, as with the previous two, but due to an error in the mitotic division of an early embryonic cell. As a consequence only certain cells show abnormal mitosis whereas the rest are normal. This shows in blood tests which first give a positive recording of trisomy-21, then a second test will show normal and a third trisomy-21 - hence the term mosaic. Generally, this is due to maternal exposure to noxious conditions at an early age, e.g. anoxia, hypothermia.

Consequently, as is recommended by Dicks-Mireaux (1972) and from results of other investigations (e.g. Käärmänen and Dingman, 1962; Moor, 1964; Gibson and Pozsonyi, 1965; Baumeister and Williams, 1967; Rosecrans, 1968; Gibson, 1973; Ikeda, 1974), a chromosomal study was made of each mongoloid child.

There is still conflicting evidence as to which of the different types of Down's Syndrome is the least retarded. Generally, research nominates translocations as the more intelligent, however there are results to the contrary of this as in both Gibson's and Ikeda's studies wherein mosaics were found to achieve higher scores in various intelligence tests; although in mosaicism there are so many different stem lines that can be affected it becomes hard to generalise on this. It is not unreasonable, however, to assume that different types may display different morphological and behavioural manifestations. Therefore the karyotype of each child was obtained which ensured that all the subjects used were of the trisomy-21 type rather than translocations or mosaics.

The control subjects used to match the Down's Syndrome children were preschoolers of four years of age. This was decided upon after completion of an intelligence test on each Down's Syndrome (1960 Revised Stanford-

Binet, Form L), from which both mental age and IQ were obtained. This particular test was chosen in accordance with the practice of related studies, (e.g. Girardeau, 1959; Thompson, 1963; Cornwell and Birch, 1969; Zekulin, Gibson, Mosley and Brown, 1974).

In addition, the quotient from the Gesell Development Schedule was calculated which gave valid information for matching subjects as the Stanford-Binet is a verbally-loaded test and could therefore be disadvantageous to the Down's Syndromes due to their poor verbal expressive abilities. It was thought that matching subjects both mental ages and developmental quotients would be more comprehensive than purely on mental age alone or IQ, as using this data assumes that the groups have been equated on some fundamental intellective dimension. However, these are both composite scores which normally reflect the operation of a variety of factors. Consequently, subjects may have the same mental age, for example, but for entirely different reasons. It is conceivable that there are quantitative and qualitative differences in ability structures and therefore differences could arise despite matching. Hence, a further means of comparison was made. The teacher in charge of the Down's Syndrome children was also consulted for his opinion as to their abilities and confirmation was given on the scores obtained in tests - that the children function at approximately the level of a four year old child.

In the past there has been much controversy over the usefulness of the Gesell Development Schedule but data from Illingsworth, (1960); Share, Koch, Webb and Graliker, (1964); Fishler, Share and Koch, 1964; Dicks-Mireaux, 1972; and Share and Veale, 1974; all show it to have great value both as a measure of the developmental level reached by the child and as a predictor of future development.

CHAPTER II

METHOD

Subjects

Sixty subjects were used in total, of whom thirty were Down's Syndrome children (mongols) and thirty were normal children. These were selected from a Psychopaedic hospital and local kindergarten, respectively, and were matched on the basis of sex, mental age (1960 Revised Stanford-Binet, Form L) and developmental level (Gesell Developmental Schedule). They were separated into four groups - normals or Down's Syndrome, and male or female.

Preschoolers were chosen as subjects from results of the tests on Down's Syndrome children wherein the mean mental age and developmental level attained was 49 months (range 45-56 months) with mean IQ of 41 (range 33-56). The mean chronological age of Down's Syndrome children was 11 years with a range 6-17 years.

No subjects had previous experience on discrimination tasks.

Stimuli

Eight stimuli were used - four wooden toy cars and four wooden acrobats. Within each set one toy was painted black, one white and two grey, as required by the different discrimination conditions. The grey stimuli were arbitrarily numbered either stimulus one or stimulus two for recording purposes, and were inconspicuously marked for identification

Two different toys were used to reduce satiation effects and thus maintain the subjects' interest.

Procedure

The experimental design was a 3 x 2 x 2 factorial arrangement with conditions of discriminability, sex and subject group as the factors. Discriminability composed the repeated measures factor.

The experimental task required the subjects to choose between two different coloured toys according to varying discrimination conditions, which were as follows:

Condition 1 - High Discrimination

this constituted a choice between a black or a white toy

Condition 2 - Medium Discrimination

a choice between a black or a grey toy

Condition 3 - Low Discrimination

the choice here was between two grey toys, each of which was marked as stated.

Each subject was tested under all three conditions and had, in total, seven choices under each condition i.e. a possible six alternatives. Seven choices were given so as to allow any variations which might arise sufficient opportunity to develop, thus enabling a meaningful comparison to be made of subjects' choice behaviour.

To prevent the order of presentation affecting results and to reduce satiation, conditions were randomized so each subject had a different sequence of presentation of conditions. Only four choices per condition were given at each testing session i.e. a possibility of three alternatives, half the total number of trials. Different discriminanda were used in the second half of each condition than were used in the first half i.e. if cars were used as stimuli first, then acrobats were used in the second half of trials. This applied across conditions also, in that if cars had been used for the trials of the previous condition tested then acrobats would be used for the next condition.

Within each trial, stimuli were presented from opposite sides to the previous trial i.e. swapped left to right and vice versa to control order effects and to observe whether or not subjects are alternating stimuli or responses. Research suggests that generally stimulus alternation rather than response alternation is the preferred strategy in choice behaviour. (Glanzer, 1953b; Berlyne, 1960; Jeffrey and Cohen, 1965).

Testing sessions were held twice weekly and were spaced so that no subject was tested every session i.e. only half the subjects of each group were tested at each session. There were five days between each half of testing and subjects were tested in a standard office setting separate from the main ward or playroom, as in the case of the kindergarten.

On entry into the testing room the subject was seated before the experimenter's desk, which was set up so as to keep stimuli from view before presentation to subjects, yet functionally set out for the experimenter, enabling rapid transposition of toys from left to right and vice versa as the experimental procedure required when trials were in progress. There was neither inter-trial nor intercondition interval other than time taken to replace and present stimuli.

Upon seating, subjects were instructed as follows: "Hello _________, I'd like you to play a game with me. I'm going to give you two toys and you can choose one to play with for a wee while then I'll ask you to give it back and let you choose again between the two toys".

After thirty seconds the stimuli were removed from sight, positions swapped and the pair of stimuli re-presented with the instructions: "Here are the toys again: choose one to play with and I'll tell you when to give it back". These instructions were repeated for the remaining trials, after which the subject returned to the ward or playroom.

The subjects were given time to play with the toys to satisfy their curiosity and to keep their interest in the tasks so it was not merely a chore of having to choose between two toys then return them. Instructions were repeated exactly for each subject to control for experimenter effects and as far as possible the experimenter had similar interactions with each one. To reduce interaction with the experimenter from influencing the subject's responses neither reinforcement nor feedback was given after any response. Thus, patterns elicited demonstrated the particular strategy chosen by the subject and the extent to which he maintained it throughout testing. In the second half of testing, instructions were again repeated as described although each child was asked if they remembered what they had done on previous meetings before giving the instructions as stated above.

Individual record sheets were kept for each subject. These had idiographic data on them - name and number of subject, chronological age, mental age, developmental quotient, plus experimental information - order of conditions used in testing as well as the toy used in each half of testing for each condition and the results of each trial i.e. the colour or stimuli choice and whether alternation had occurred or not. From this data the number of alternations per conditions was computed as well as first choice preference and stimuli preference, if any existed. In addition to this, subjects were checked off a master sheet upon completion of all of the trials for each condition.

A pilot study on six preschoolers and six Down's Syndrome children was carried out before the main investigation in order to check the proposed procedure. Of primary concern was the ability of the Down's Syndromes to comprehend the necessary instructions and their motivation to perform the tasks. In both, their use as subjects was substantiated.

Also, from pilot study results, the amount of time to allow subjects with the toy once the choice had been made was reduced from sixty seconds to thirty seconds. In addition, pilot study results suggested a minor alteration to the procedure for condition three of low discrimination.

Here, when presented with the cars as stimuli, subjects found it very difficult to discriminate between them and so resorted to positional alternation rather than alternating stimuli as had been used in the other two conditions and for the acrobats in condition three. However, this confounded results due to the layout of the recording sheet.

The sheet then read as if no alternations had occurred when in fact there had been. This was because stimuli were being swapped from left to right (and vice versa) by the experimenter and as a result a record of either all Stimulus (1) or Stimulus (2) was being taken.

It was decided, therefore, not to swap cars in condition three but just to remove them from sight as in the normal procedure and present them to the subject unchanged positionally. Thus, the alternation behaviour was still recorded, although it was noted on the record sheets this was positional and not stimulus alternation i.e. subjects had changed strategies of choice, and condition three was said to have two subconditions:

Subcondition (A) using the cars, in which stimuli positions were not swapped and in which subjects tended to alternate responses left to right

Subcondition (B) using acrobats and swapping their positions, in which subjects tended to alternate the stimuli themselves.

Treatment of stimuli in this way gave opportunity to substantiate whether hypotheses by Glanzer (1953b), Berlyne (1960) and Jeffrey and Cohen (1965) were correct: that alternation occurs with respect to the stimuli themselves rather than position of the last response made.

The topic of interest in the present study was the comparison of alternating behaviour exhibited by the four groups of subjects, whether it was colour or positional (i.e. stimulus of response alternation) was not the main issue. However, the use of the subconditions permitted insight into the actual strategies used by each subject when solutions were not obvious, as in the other conditions.

Owing to the results of the statistical analysis on the initial experiment, a further set of testing ensued. However, due to accommodation changes within the hospital, and in effort to minimize ward routine disruption, there was only a limited amount of time available to be spent with subjects. Consequently, due to the mystifying data obtained from the analysis, only condition three was further investigated.

There were added difficulties in that ten of the kindergarten children originally used as subjects had turned five years of age and were now at school, hence no longer available for retesting. Despite this, condition three was retested using the same experimental method but with an unequal cells design. This was done approximately three months after the initial testing as subjects used were in the experimenter's hometown and further testing had to coincide with University vacation periods.

CHAPTER III

RESULTS

Two analyses of variances were computed, one on each set of data. The first consisted of a Conditions X Group X Sex analysis of variance. The second was to examine the influence the different stimuli might have had on results.

Due to the unavailability of some subjects for retesting it was an unequal groups design in the second analysis, i.e. 3 x 2 x 2 x 2 factorial arrangement, unlike first analyses, with Conditions X Group X Sex X stimuli (cars, acrobats) as factors. On inspection of the data, however, it was clear that no difference existed at any stage or in any condition between the two stimuli (as can be verified on inspection of raw data in the Appendix). Thus, the second analysis was of the same format as the first with Conditions X Group X Sex as factors.

The first analysis of variance (see Table I) indicated no significant main effect for either the Group or Sex factors and no interaction effect between them. However, there is a significant main effect for factor C, the discrimination conditions, ($F_{2/112} = 9.84$, $p < .01$) and a significant interaction effect for Conditions X Group ($F_{2/112} = 9.37$, $p < .01$). No other main effects or interactions reached significance, that is, there were no sex differences interacting with the discrimination conditions factor nor was there any significant effect for the interaction of Conditions X Group X Sex.

Table 1. Analysis of Variance on Series One

Source	SS	df	MS	F	P
A	0.355	1	0.355	0.31	n.s.
B	0.088	1	0.088	0.08	n.s.
AB	1.423	1	1.423	1.244	n.s.
error within	64.045	56	1.144		
C	14.011	2	7.006	9.84	< .01
AC	13.345	2	6.672	9.37	< .01
BC	0.145	2	0.073	.11	n.s.
ABC	0.144	2	0.072	.11	n.s.
error	79.688	112	0.712		

Factor A = Group (binary factors: Down's Syndrome and Normals)

Factor B = Sex

Factor C = Conditions

n.s. = not significant

The significant effects indicated by the anova warranted closer inspection, hence a table was made of the percentage of alternations made by the two groups of subjects under each discrimination condition (see Table II). T tests were computed for this data to see if there was a significant difference in alternation between conditions. Results are shown in Figure I. The only significant difference found in alternation was between conditions two and three for the normal control group (+ = 3.02, df = 112, $p < .01$). T tests comparing control group alternations with Down's Syndrome alternations also reached significance on Condition One ($t = 2.382$, 58df, $p < .01$) and Condition Three ($+ = 2.980$, 58df, $p < .001$).

Table II. Percentage Alternation of Subject Groups under each condition

	1	2	3
M	86.17%	91.17%	87.17%
N	95.5%	90%	74.5%

M = Down's Syndrome subjects

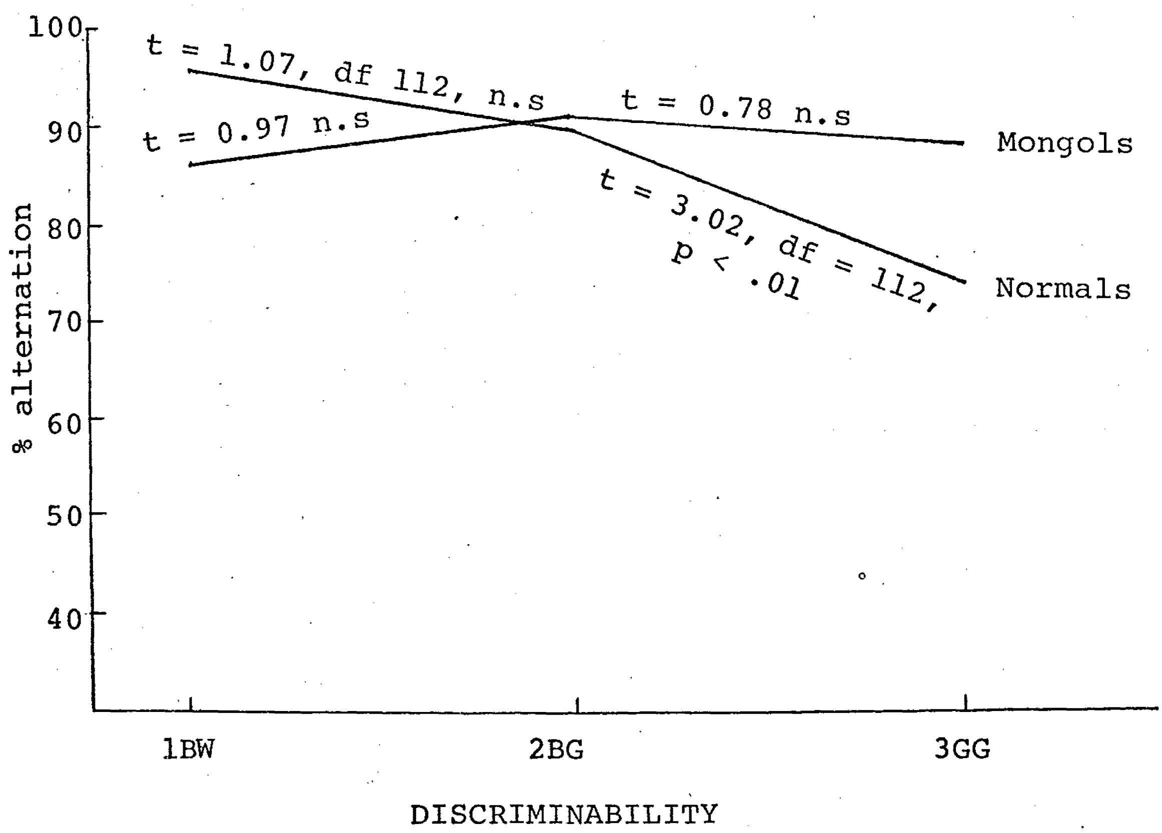
N = Preschoolers

As hypothesized, under each condition both groups of subjects alternated well above chance; however, the rate of alternation decreased as a function of the discriminability conditions for the control group only, showing a significant drop between second and third conditions presumed due to the increasing difficulty of the discriminability between stimuli.

Quite different results were obtained from the Down's Syndrome group in that they showed no significant difference in performance among any of the conditions. (See Table III).

Results of the second anova verified findings of the first analysis. Again the only significant main effect was for the discriminability conditions factor ($F_{2/92} = 4.92$, $p < .01$) and again there was evidence of a significant Conditions X Group interaction ($F_{2/92} = 4.03$,

FIGURE I. Relationship Between Discriminability and Alternation.



Condition 1 - Black-White

Condition 2 - Black-Grey

Condition 3 - Grey-Grey

$p < .025$). (See Table IV and Figures II and III).

Table III. Analysis of Variance for Second Series.

Source	SS	df	MS	F	P
Between					
A	0.47	1	0.43	.38	n.s.
B	0.36	1	0.32	.29	n.s.
AB	0.36	1	0.32	.29	n.s.
error within	51.57	46	1.12		
C	7.87	2	3.94	4.92	< .01
AC	6.44	2	3.22	4.03	< .025
BC	1.67	2	0.84	1.03	n.s.
ABC	0.71	2	0.36	0.45	n.s.
error	73.61	92	0.80		

Factor A = Groups

Factor B = Sex

Factor C = Conditions

n.s. = not significant

Table IV. Percentage Alternation of Subject Groups under each Condition. Series 2.

	1	2	3
M	86.17%	91.17%	86.17%
N	95.50%	90%	80%

A further table (see Table V) was made showing

FIGURE II. Relationship Between Discriminability and Alternation

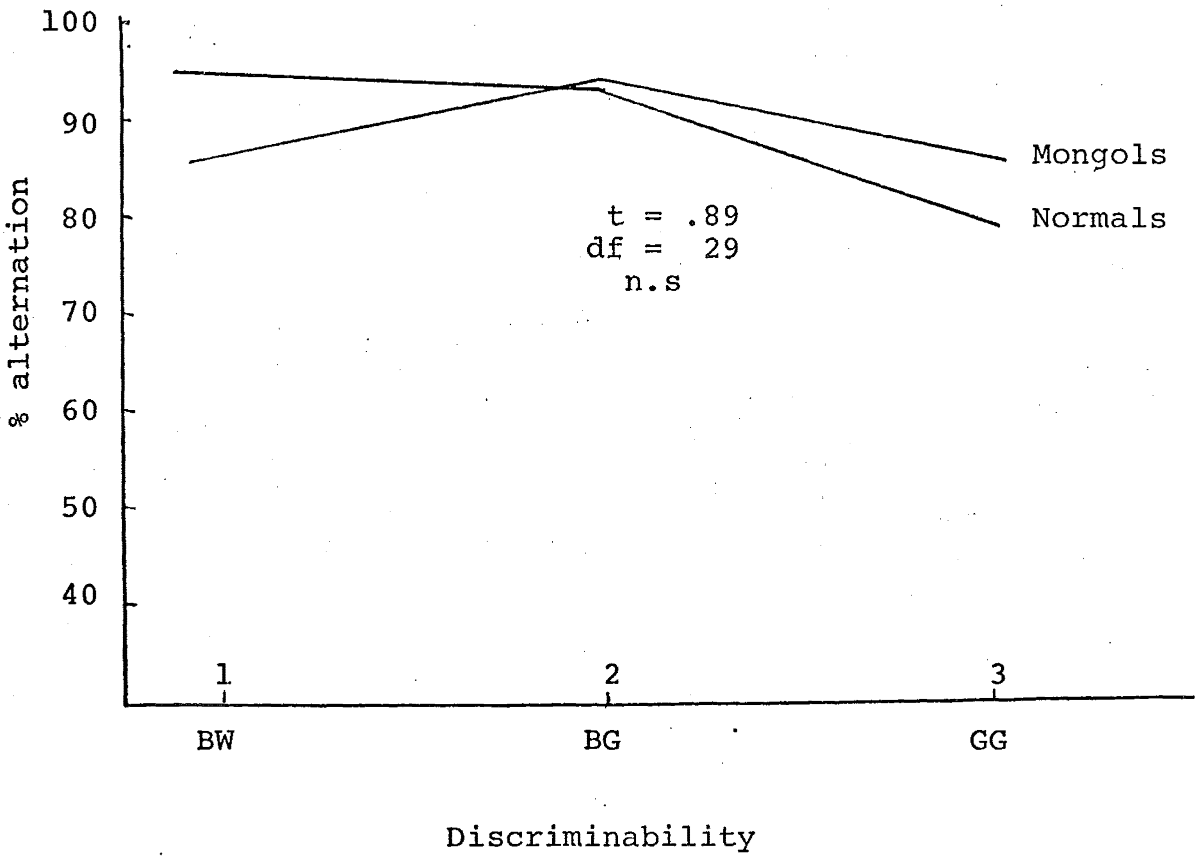
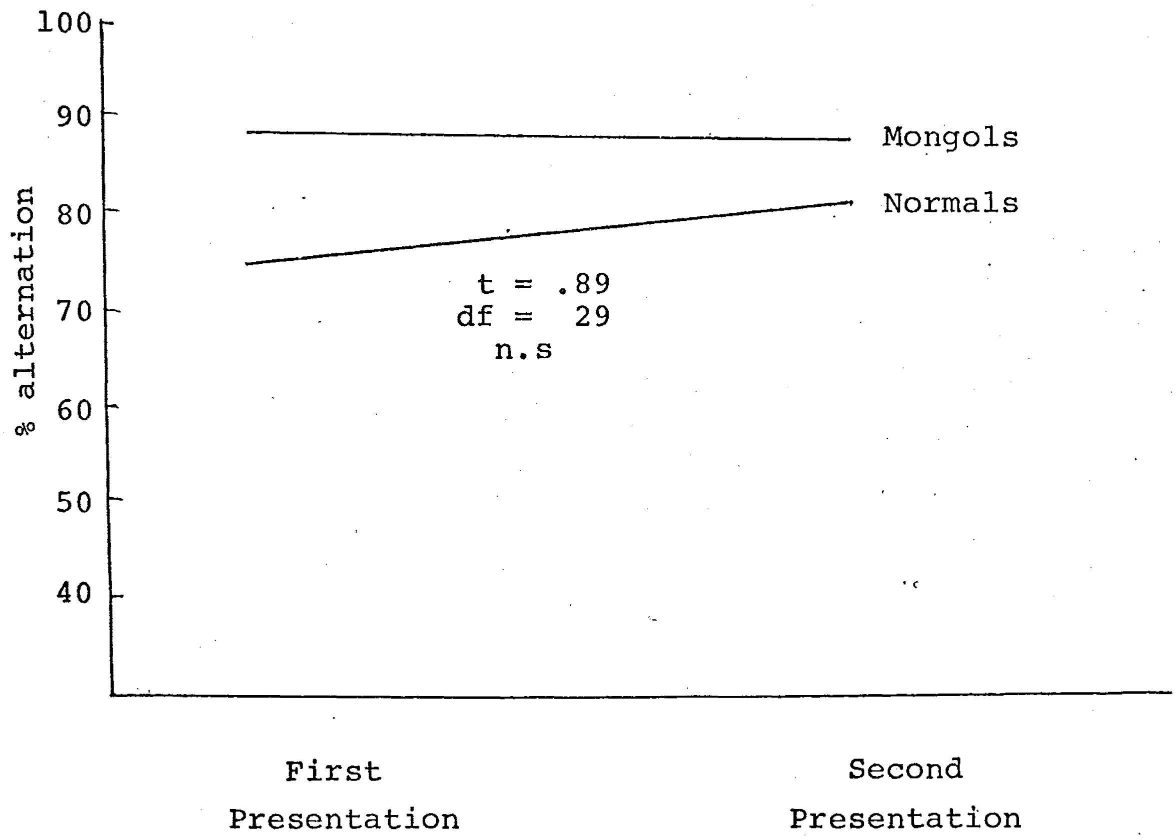


FIGURE III. Variability in Groups Performance in Condition Three for Series 1 and 2



the percentage of alternation in both groups using the new figures for Condition Three. Results were very similar to the first set of data obtained. Graphs of the figures showed that, although there was a slight difference in the control group alternations, both groups' performance in the alternation tasks lay in the same direction as it had been previously (see Figure II). The T test results showed this was not a significant difference ($t = .85$, $df = 29$), nor was there a significant change expected in the Down's Syndrome group's data, being only 1% difference from previous testing. Hence, little variability in performance of either groups was in evidence (see Figure III).

Table V. Percentage alternation for both groups summed over all conditions for first and second series.

	M	N
First Series	88.14%	86.66%
Second	87.77%	88.51%

A comparison of total alternations for both groups in both series of testing was made (see Table V) to assess if there were any practice effects and to summarize previous information on the overall rates of alternation for each group. Inspection of the data showed there was only slight difference between groups, hence no evidence of any such effects confounding results from having repeated conditions.

In summary, from results it appears that alternation is part of the repertoire of behaviour for both groups of subjects. However, it is affected by the degree of discriminability attached to tasks and this affects the alternation behaviour of each group differently. The normal control group responded as hypothesized, with alternation a decreasing function of discriminability, whereas Down's Syndrome subjects showed little variability between the different discrimination conditions. In connection with this it is interesting to note that the Down's Syndrome subjects alternated at a significantly higher rate than the normals in the most difficult condition (Condition Three), yet lower in the easier one (Condition One). These differences in behaviour disappear in comparing the total alternations of each group. Nor was there any sex differences found in alternation behaviour. Finally, the differences in alternation according to discriminability do not appear to be significantly related to the stimuli used, as further analysis showed, although it was recorded throughout testing that in Condition Three both groups of subjects used different strategies for the different stimuli in making their response.

CHAPTER IV

DISCUSSION

Related Findings

Alternation has been established as the favourite sequence of response in binary-choice situations (Gerjuoy and Gerjuoy, 1964, 1965). From their research Berenbaum and Aderman (1964) and Gerjuoy, Winters and Hoats (1966) found not only did both normal controls and retardates alternate above chance, but retardates alternated significantly more than normals. A related study by Gerjuoy and Winters, (1967) substantiated this and, generalizing from other results, found that alternation was directly related to the gradient of task difficulty in that, as the task became harder i.e. stimuli more difficult for discriminating between, the amount of alternation increased whereas when it became easier, alternation decreased.

Iwahara (1959) had conducted a study of similar vein using third and fourth grade children though obtained contradictory results. She found that the tendency to alternate was higher when two choice objects were differently coloured and thus easier to differentiate than when objects were similarly coloured and posed some difficulty in distinguishing.

Only Iwahara's findings were supported in the present study. In the normal group, as in Iwahara's study, alternation was higher in the Black/White condition

(Condition One) than in the more difficult Grey/Grey condition (Condition Three); whereas the retardates, surprisingly, were not affected by the task difficulty - with similar alternation numbers for each condition. Hence, no support for Gerjuoy and Winters was found in this direction, although, in comparing the alternation rate across subject groups i.e. between normals and retardates rather than among conditions for each group, retardates do alternate significantly more under the difficult conditions than normals and alternate less in the easier condition. From interpreting results this way, there is a similarity, in part, to Gerjuoy and Winters. However, as these differences in the groups' performance are not significant overall, the earlier postulate of Gerjuoy, Winters and Hoats is not supported - in this study alternations were not greater for retardates than normals.

Strategies Involved

The question arises from these results as to what is affecting the Down's Syndromes' performance making them unresponsive to the different discrimination conditions when preschoolers responded precisely as predicted? This calls into question the possible strategies being used by subjects in making their choices.

Gerjuoy and Winters (1968) believe most behaviour can be analysed into lawful components. According to them, binary-choice decisions can be analyzed into the three major components of stimulus preferences, response preferences and choice-sequence preferences.

Subjects enter most experimental situations with preferences for some stimuli, preferences that have developed often as a result of a learned bias, e.g. in coin tossing most subjects first call "heads". Other examples are colour preferences, form preferences etc. A stimulus preference is inferred when a subject responds more frequently to one stimulus than to any others. It is based upon the nature of the individual stimulus and is unrelated to the configuration of the stimulus display.

A response preference is demonstrated when a subject responds to the stimulus without regard for the differential characteristics of the stimuli, by choosing the response on the basis of its position in the stimulus array. It is synonymous with position preference and is the most common response preference i.e. choosing the response according to preference for either the left or right sides in a two-choice decision. The side of the initial preference is related to the type of material. If the material is alphabetic the preference is for left-hand stimuli; if non-alphabetic (i.e. numerical or nonsense figures) the initial preference is to the right.

Thus, when a subject is instructed to choose between two stimuli, his response to the stimuli is not random even when he is instructed to guess or when he has difficulty in perceiving differences between the stimuli. As indicated, he may have a stimulus or response preference, or he may have a choice-sequence preference which may be exhibited over a series of trials by the pattern of response. This pattern may be a repetitive one (e.g. perseveration, alternation) known as invariant alternation, or it may be a tendency to alternate more than expected by chance. Although a stimulus preference is dependent upon some characteristic of the stimuli and response preference is dependent on the structure of the stimuli array, a choice-sequence preference is contingent upon the previous responses which may be made according to whatever cues the subject can find to accommodate his preferred strategy.

Reviewing the present results and those cited by others,this division into components could well facilitate investigations. Although Iwahara does not consider possible stimulus, response or strategy preferences in alternation, this could be where the difference between hers and other studies cited lie; in the fact that the different subjects used in each experiment employ different strategies in binary-choice decisions.

Iwahara's normals,if alternating according to the stimuli themselves,would obtain the results reported, as is also observable in the present study. Alternation is higher where subjects can easily distinguish between stimuli (Condition 1) than where it becomes more difficult for such discrimination (Condition 3) which affects their strategy, resulting in decreased alternation as seen in Figure I and II.

The Down's Syndrome children could be using the same strategy as retardates in Gerjuoy and Winter's research, a choice-sequence preference of invariant alternation, alternating all responses whether discriminating between stimuli (choosing colours) or positions (alternating responses left to right). Although the alternation rate did not follow the same pattern as retardates did in both Berenbaum and Aderman's, and Gerjuoy and Winter's investigations (probably due to certain differences in experimental tasks), the suggestion by the latter authors - that the amount of alternation could be used as an index of task difficulty - is still applicable. According to this, because there was little variation in alternation rates over the different conditions for the Down's Syndromes it can be said that the different experimental tasks posed the same degree of difficulty; for the normals, conditions got gradually harder, hence the decline in alternations. There were no clinical observations noted by the experimenter of any apparent change for the Down's Syndrome children in responding to the different tasks, whereas normals appeared to debate over the choices in the third condition.

In future, studies investigating alternation behaviour should perhaps analyse resulting responses into components discussed and identify the actual form of responding, as this could be influential in the interpretation of results, not only in the actual research but also when under consideration by others.

The design of the present study, especially with the division of Condition Three into subconditions as well as subjects not receiving reinforcement, enabled such an identification. Patterns elicited through this technique demonstrate the effects of all three preferences and their interactions. The outlay of the record sheets ensured any stimulus or response preferences would show on results as no alternations would be scored but rather the preferred stimulus or position would be shown.

Identification of Strategies

The Anovas computed on data showed a significant effect for conditions and a significant interaction between conditions and groups. As sex was not found to influence results nor were the types of stimuli used, attention is drawn to the varying discrimination conditions and their effects on subject groups. As previously stated, the preschoolers were affected as hypothesized but Down's Syndromes were not. Possible reasons for the differential effects conditions had on the two groups involve a number of factors.

After summarizing the findings of a number of studies investigating factors involved in binary-choice decisions, Gerjuoy and Winters (1968) note two variables as affecting preferences in response which are prime factors in the present study.

The first is access to previous results. The second, particularly with younger or lower mental age subjects, there may be such a strong choice-sequence preference, such as alternation, that this preference may override any stimulus or positional preference. The influence of the first variable on performance in this study cannot be discounted entirely. Essentially, it involves that having access to previous responses, subjects may look back at them, notice that they have responded inequitably to the one side or the other (or one stimuli or other) and try to balance this by their future responses. Although subjects in this experiment could not actually see the written record of their responses, there was no interval between trials, therefore, they could recall responses made on the directly previous trials and correct for alternation if so desired. This is not held true in this case, however, especially for Down's Syndromes.

It is the second variable which appears to be the more significant as subjects were both young and of lower mental age. In view of the results obtained, it is suggested that the postulate of the second variable was in fact the case in this study. Subjects in both groups were behaving according to a choice-sequence preference. No evidence was found to suggest that subjects had either a stimulus or response preference.

Observations of the phenomenom of choice-sequence preference date back to the psychophysical studies of the 1920's. Fernberger (1920) and Arans and Irwin (1932), for example, found that subjects avoided repetitions of the preceding judgement in a weightlifting experiment i.e. they found subjects tended to alternate judgement above chance. As stated, in choice-sequence preferences each response is dependent upon the previous response and responses may arise from any number of cues according to whatever accommodates the preferred strategy.

It appears both subject groups had a choice-sequence preference in the present investigation, that of alternation. In the first two conditions their responses were made according to the colours of stimuli - merely alternating one for the other throughout the trials. However, in the third condition discrimination between stimuli was more difficult. In subcondition (B), subjects alternated as before, apparently able to discriminate between the two stimuli by some distinguishing characteristic of each toy; but in subcondition (A) it appeared subjects could no longer distinguish between stimuli and consequently records showed responses were elicited according to position, swapping responses right from left. Although there was no difference overall in alternation numbers for the two stimuli, there appeared to be a distinct difference between the strategies used for each one; and there was a significant difference in alternation rate between the groups for the collective condition, as was also the case for Condition One.

Identification in Related Studies

The finding of subjects' preferences to use stimulus alternation above positional alternation corresponds to studies which maintain that it is the stimulus which is responsible for evoking alternation of response, rather than the position of the last response. If alternation was not due to something intrinsic to the stimuli itself, results would have showed response alternation rather than stimulus alternation. Montgomery (1952) and Glanzer (1953b) claim alternation involved changing stimuli rather than response due to stimulus satiation and Berlyne (1960) also proposes that behaviour is initiated by the activating properties of the stimuli but attributes it to novelty, not satiation. This was substantiated by Ellis and Arnoult (1965) who, from their study, could find no support for Glanzer's hypothesis, declaring it too vague to account for alternation, but found Berlyne's hypothesis relevant to results of their study.

In their research, following Dember and Fowler's (1958) work, Jeffrey and Cohen (1965) also found support for this, that alternation occurs with respect to stimuli rather than the last response. The findings of the present study substantiate those of Gerjuoy and Winters (1967) who found when subjects could no longer solve problems logically by judging the stimuli, they resorted to positional alternation; suggesting that stimuli are the preferred mode of response, followed by response alternation when no other cues can be perceived.

The available evidence suggests that these preferences and their relative importance develop and change over time. These changes may, however, be differentially affected by chronological age, mental age or intelligence quotient. Indeed, chronological age has been shown to affect alternation in many studies.

Relationship with Age

Schusterman (1964) found five year old children tended to alternate whereas ten year old normals had no significant response tendency. Some of his retarded children (C.A = 10, M.A = 5) perseverated whilst others alternated, the switch from the strategy of perseveration to the strategy of alternation occurred at about M.A of five or six. Miller, Manley and Moffat (1969) agreed with this finding as did Pate and Bell (1971), that ten year olds still alternate but not significantly, though they postulate seven years as the maximum for alternation.

Gratch (1964) covered two to eight years of age. He found two-three year olds perseverated but after three and a half years there was an abrupt shift to alternation, then at five and a half years of age there was a reduction in consistent alternations. Because he included a wider range than Schusterman, he therefore found a shift away from alternation to more random responding in a younger age group than Schusterman did. Jeffrey and Cohen's (1965) results were consistent with Schusterman. They found three year olds to perseverate and four and a half year olds to alternate. An intermediate group of four year olds did not exhibit a preference for either, thus they found the mean age shift from perseveration to alternation in normal children. Rieber (1966) found preference to alternate a response pattern at four years of age through until eight years but a drop at ten years. This may appear in conflict with Gratch, but a reanalysis of the latter's subjects reveals that alternation amount was 70.3%. Thus, it appears that, although five year olds rarely alternate persistently, their alternations are well above chance.

In any analysis of alternation behaviour it is necessary to make the distinction between invariant alternation and alternation above chance as they are undoubtedly two separate processes. Invariant alternation is a single strategy used throughout a task , whereas 'above chance' alternation may be a form of behaviour that masks a number of different strategies that may or may not change during a task.

According to this, Gerjuoy and Gerjuoy (1964, 1965) found in their study of middle grade and high grade retardates both groups were invariant alternators although the high grade group alternated less invariantly than the lower grade retardates. They also found normal nine and ten year olds to alternate above chance but not invariantly and the same was found for college students. Thus, overall alternations decreased with increasing mental age.

In summary, research shows that alternation is a preferred response strategy of all groups except very young children and very low retardates who perseverate in their response. Above this low mental age range, alternation is strongest in retardates and normal children four years old. Initially, invariant alternation is the most popular choice-sequence preference. Retardates over a wide age range from early adolescence to adulthood prefer this mode of response. However, above this age, even when not alternating consistently, normal children will still alternate above chance, although this tendency decreases with age. It has been reported that even bright adults tend to alternate above chance in many diverse tasks (Gerjuoy, Winters and Hoats, 1966).

In analysis of the alternation behaviour in the present study, the Down's Syndromes appeared to have adopted invariant alternation as their preferred choice-sequence. Consequently, no differences showed between conditions in their results. They alternated at a high level throughout the conditions and performance depended on the previous response strategy, using any cues in order to alternate. (As stated, colour was the most obvious cue in the first two conditions replaced by positional alternation in the more difficult subcondition).

In contrast, the preschoolers, although also achieving a high level of alternation, were not alternating invariantly but were alternating 'above chance'. They appeared to be judging the different stimuli, then making their choice and consequently were affected by the discrimination conditions. In the third condition, when differences were minimal, this group found the task more difficult and although they too used positional alternation, as previously discussed, they did not transfer as easily to the different means of discrimination as the Down's Syndrome group did, as inspection of results shows. Hence preschoolers alternated at a significantly lower rate in this condition than the Down's Syndromes.

Evidence of Rigidity of Responses

It has been stated that both groups exhibited a choice-sequence preference of alternation though the Down's Syndromes alternated invariantly while preschoolers responded more randomly (though still alternated above chance). The difference between the two groups could be due to differences already noted as a developmental trend. It is suggested that Down's Syndromes perseverated in their response strategy, hence results show invariant alternation; this could be related to rigidity of thought, both of which often accompany retardation and brain damage (Mischel, 1973). Evidence for rigidity can be seen in results - Down's Syndromes showed little variability throughout testing whereas preschoolers did not. The variability shown in preschoolers' performance is perhaps evidence of their more flexible thinking and hence, more random responses.

Rigidity of thought has been investigated by several authors. Lewin (1935) investigated this at length and is one of the main theorists in this area. His hypothesis is that, in comparison with normal children, the boundaries within the life space of the retarded are more rigid and that greater functional rigidity of the retardates causes them to cling to a fixed habit. Some research has been directed towards this but results have not found support for the Lewinian theory - retarded subjects have not displayed more rigid behaviour any more frequently than normal subjects, (Kounin, 1941, Plenderleith, 1956; Stevenson and Zigler, 1957).

However, a recent study directed by Hughes (personal communication) has found that there is some rigidity of response in alternation of an older group of low grade retardates in that they showed perseveration of their preferred response strategy. This was affected by intertrial intervals .The longer the intervals, the less rigid in response compared to normals, who were varying their responses, choosing a different strategy each time. Similar results were reported in this investigation as in the one under consideration concerning strategies chosen by the groups - retardates were unaffected by experimental conditions and continued to alternate responses despite any difficulty found in the tasks by the normal group. This is evidence for the existence of rigidity, shown by the retardates response perseveration. Therefore it could be an equally applicable explanation for the results found in the Down's Syndrome children in the present study.

Cognitive Functioning

The differences in results of the two groups in this study may be related to slower processing of information in the retardate compared to normals, as found in research by Spitz (1963), Iwahara (1959) and Gerjuoy, Winters and Hoats (1966). In tachistoscope experiments it was found that retardates are unable to process incoming information as completely and as quickly as normals. In 1928 Brousseau and Brainerd introduced the notion of a characteristic cognitive style for Down's Syndrome individuals which was supported by subsequent studies. Zekulin, Gibson, Mosley and Brown (1974) believed this characteristic cognition incorporated, as well as motor and language limitations, an attentional deficit which prevents more efficient functioning by the Down's Syndrome individual due to minimal information input rather than slower processing. Siudzinski (1966) investigated the distractibility of retardates, as did Maggs (1974), and found subjects showed an inability to attend relevant stimulus dimensions and appeared to attend more to the surrounding distracting stimuli, to the detriment of the task. This corresponds to Zekulin et al's conclusion - that Down's Syndrome cognitive processes suffer an inhibitory deficit causing them to habituate very slowly to distracting stimuli which affects their performance in the necessary tasks.

Spitz maintains that there are physiological differences between normals and retardates of the same age. However, this is a controversial view and more generally it is believed that there are no differences in cognition processes but that cortical changes transpire more slowly in the retardate, hence he is functioning at a different rate than normals. If in fact this is the case, then the retardates might settle for any form of problem-solving they find will work and continue to use this in future tasks.

An analogy could be drawn between this and the formation of learning sets. As yet there is little information on the formation of learning sets in the mentally retarded, although Ellis (1958) has found evidence for their existence in high and low grade retardates. Studies by Gerjuoy and Gerjuoy (1965) and Gerjuoy and Winters (1968) suggest both normal and retarded subjects have initial preexperimental sets that influence their responses. Subjects' results in the present experiment show evidence of such influence, exhibiting a choice-sequence preference (though to different degrees). It is proposed that the Down's Syndrome children, having completed one trial by using their preferred strategy (alternation), continued to perform in the same manner, and hence the formation of a type of learning set for responding to the particular problem at hand. This, of course, is reinforced by the basic rigidity in their thinking and problem-solving.

Response Hierarchy

A further interesting point arising from results is that there is some evidence of a response hierarchy in which positional alternation represents a lower form of response than does stimulus alternation. This is suggested as inspection of results shows that positional alternation is employed only in lieu of other forms of response. Both groups resorted to alternating from side to side when stimuli were more difficult to discriminate between i.e. when other obvious cues were not available.

This bears resemblance to studies by Schusterman (1963, 1964) and Gerjuoy and Winters (1968) which test the existence of a response hierarchy. These investigations maintain: when one form of response in the hierarchy cannot be applied then another one is employed in its place. Hence, in this study, when alternation according to colour could no longer be employed, subjects regressed to positional alternation. This substantiates research by Peters and Penney (1966) who found, using fifth and sixth grade children, that when confronted by a more confusing or difficult task, each group regressed to a lower form of response.

Relationship with Mental Age

So far it has been suggested that differences in rates of response of the two groups are due to differences in strategies adopted in solving the problems and even basic cognitive differences. A further reason for the difference could be related to the response hierarchy suggested. It has been said that tasks were more difficult for the preschoolers because they responded according to the stimuli themselves. Hence, when it became harder in Condition Three to perceive cues, they too resorted to positional alternation. However, the transition to this form of alternation involved regressing to a lower level of response which the preschoolers appeared to find more difficult than the Down's Syndrome children (as evidenced by their lower rate of response). They appeared to continue to attempt to respond according to stimuli.

Reasons for this again relate back to possible differences in cognitive processes. Gerjuoy and Gerjuoy (1964, 1965) have found that preferences for strategies used in decision-making are affected not only by chronological age but also mental age and I.Q. They have found that the numbers of invariant alternations decrease in the more intelligent groups. This could be related to present findings. Although discrimination is a relatively simple task, a broad range of psychological processes are involved, including attention, perception, inhibition, motivation, reinforcement and memory; and although subjects have been matched for mental age, this is not synonymous with having equal behavioural capabilities. Subject groups equated on mental age may differ in a number of experimentally relevant capabilities, such as those noted. Pertinent ones being memory, attention and inhibitory mechanisms.

A number of researchers have cautioned others against the use of M.A for matching subjects (for example, House and Zeaman, 1963; Smith and Wilson, 1973). Baumeister (1967) noted the dangers in using this measure also. He claims most researchers assume groups equated on it are equated on some fundamental intellective dimension but, as M.A is a composite score, it reflects the operation of a variety of factors. Subjects, therefore, may have the same M.A, but for entirely different reasons, and still be functioning at the same level, but in quite distinctive ways.

This could well be true in the case of the subjects used in this study. Due to the difference in chronological age between the two groups (preschoolers four years, Down's Syndromes six to seventeen years) there could be certain psychological processes influencing response strategies and rate of response which are quite distinctive from one another, hence confounding extrapolations from results.

Relationship with Perceptual Levels

In connection with this, discrimination, as stated, involves many psychological processes one of which is perception and as perception differs according to developmental levels this could be another distinguishing feature of the response strategies of each group of subjects.

Mead (1934) and Piaget (1950) both interpret perseverations and alternations in the more general framework of maturity of behaviour. According to Piaget the young child's perception is "centred" in the sense that its organization is dominated by Gestalt-like principles of proximity, closure, form etc. i.e. "field effects". With age and the development of new mental structures, the child's perception is progressively freed from its domination by field effects and becomes increasingly logical in form (decentring).

In the process of centration of colour — form perception the child's attention is decentred from colour, the most dominant characteristic, and attends more readily to form. Corah and Gospodinoff (1966) state this is the same for whole-part perception, based on Meili-Dworetzkis (1956) work. They maintain that with development there is a progression from early global wholes to the more articulated parts. The child can see the relationship between parts to the whole.

There has been much research directed at verifying Piaget's theory which, in general, has found evidence for the existence of such processes. Elkind, Koegler and Go (1964) tested four through to nine year olds' ability to perceive both parts and whole of arrays and found there was a regular increase with age in ability to perceive parts and whole. By nine years, integration of both was achieved. Schaie (1968) used a colour-pyramid test and found that retardates exhibited less form dominance than normals and relied on colour to a greater extent than normals did. Supportive results have also been found, for example, by Wilcock and Venables (1968); Klein, Klein, Oskamp and Patnode (1972); and Cornwell and Birch (1974).

These findings could be related to differences found in responses by the subjects. Piaget postulates that development from one level to another is unique to each child, there being no specific ages at which this occurs. Hence, the strategy adopted by Down's Syndromes could vary from those adopted by preschoolers according to the perceptive level at which they are functioning. However, at present this can only be speculated on -

research designed specifically for this investigation would be necessary.

CHAPTER V

GENERAL CONCLUSION

The present study was undertaken to investigate the effect different conditions of discriminability had on the spontaneous alternation behaviour of Down's Syndrome children and preschoolers. The alternation behaviour of the former group of subjects was unaffected by discriminability but results to the contrary were obtained for preschoolers, whose alternation decreased as discriminability became more difficult. This supports findings by Iwahara (1959).

An analysis of strategies found that, although both groups exhibited a choice-sequence preference of alternation, they differed in that preschoolers alternated above chance and based responses on stimulus characteristics whereas Down's Syndromes alternated invariantly, following whatever cues were available. In relation to research directed by Hughes (1976), it is suggested that the perseveration shown by Down's Syndrome subjects in response strategy is indicative of rigidity of responding believed to be a feature in the characteristic cognitive style of Down's Syndrome individuals.

Substantiation of these findings could well be significant for care and education of the mentally retarded. As Clinton and Evans (1971) have suggested, the special education necessary for such groups could well profit from consideration of alternation as one of the response tendencies employed by this group and thus adapt styles of teaching according to this and from knowledge on learning sets. Consideration of perceptual levels - colour - form , part - whole - could also play an important part in content and method of teaching, as could the findings by Zekulin et al (1974) of attentional deficits impairing performance in this group rather than cognitive impairment.

Consideration of these variables and others suggested as influencing Down's Syndromes' performance, and possible application in the various institutions and clinics could give such research important application and show its value as a contributor, not just in extending knowledge of the various psychological processes of mental retardates, but also something concrete, of practical value to be used in the general care and education of this population.

SUGGESTIONS FOR FUTURE RESEARCH

Weaknesses and suggestions arising from this research carry implications for future study. Some issues of particular importance are as follows:

(1) Care should be taken over the matching of subjects in relation to mental age. Coloured Progressive Matrices could be used as an alternative to the matching procedure used in this study (of chronological age as criterion for normal subjects and Stanford-Binet mental age scores for subnormal matching). This test could be used for both populations and has been found a valid alternative to the Binet (Williams and Wilcock, 1966). It has been suggested that control subjects consist of two groups - those matched on mental age plus those matching chronologically. Further, adults could be included as an additional subject group. In this way problems over the use of mental age could be overcome as it is conceivable there are qualitative and quantitative differences in ability structures, therefore differences could arise despite careful matching of mental age . Consequently, additional measures are necessary to ensure subjects are well-matched.

(2) More efficient experimental tasks could be employed. Recording alternation from the tasks employed in this study is not as efficient as more sophistocated means, such as paper and pencil tests of T-maze tracing or using coloured beads and perspex tubing.

(3) Introduction of an additional variable of an intertrial interval could shed more light on information obtained, especially as regards the question of rigidity of response. Intertrial intervals could be introduced to measure differences in response after a lapse of time, to see effects on the strategies employed by subjects and query the persistence of rigidity.

(4) Latency between choices could be measured to give further information on possible strategies used.

(5) Results could be tested by replication at another hospital and kindergarten. The hospital used in this study is smaller than other similar institutions which could affect the nature and quality of care given to the children. The child's development is very much dependent upon hospital conditions.

(6) Further investigation could be made as regards analysis of strategies used in responding. More empirical evidence is necessary here. This also applies to research into perceptual levels in the child. Further research could contribute much to the understanding, and aid the development, of the mentally retarded.

REFERENCES

ARANS, L. and IRWIN, F. W. Equal weights and psychological judgements. J. Exptal Psychol. 15, 1932, 733-756.

ARCHER, E. J. Concept identification as a function of obviousness of relevant and irrelevant information. J. Exptal Psychol. 63, 1962, 616-620.

BAKAN, P. Response-tendencies in attempts to generate random binary series. Amer. J. Psychol. 73, 1960, 127-131.

BALLA, D. and ZIGLER, E. Discrimination and switching learning in normal, familial retarded and organic retarded children. J. Ab. and Social Psychol. 69, 1964, 664-669.

BAUMEISTER, A. A. Problems in comparative studies of mental retardates and normals. Amer. J. Ment. Defic. 71, 1967, 869-875.

BAUMEISTER, A. A. and WILLIAMS, J. Relationship of physical stigmata to intellectual functioning in Mongolism. Amer. J. Ment. Defic. 71, 1967, 586-591.

BERENBAUM, H. L. and ADERMAN, M. Comparison of binary guessing response tendencies of normal and retarded children. American Psychologist. 19, 1964, 466.

BERLYNE, D. E. Conflict, Arousal and Curiosity. McGraw-Hill Series in Psychology. McGraw-Hill Book Co., 1960.

BERLYNE, D. E. and SLATER, J. Perceptual curiosity, exploratory behaviour and maze learning. J. Comp. Physiol. Psychol. 50, 1957, 228-232.

BOURNE, L. E. Effects of delay of information feedback and task complexity on the identification of concepts. J. of Exptal. Psychol. 54, 1957, 201-207.

BROUSSEAU, K. and BRAINERD, M. G. Mongolism: a study of the physical and mental characteristics of mongoloid imbeciles. Baltimore: Williams and Wilkins, 1928.

CANTOR, G. A. Responses of infants and children to novel and complex stimulation. Advances in Child Dev. and Behav. 1, 1963, 1-29.

CLINTON, L. and EVANS, R. Single alternation discrimination learning in retarded adolescents as a function of within-trials variability. Amer. J. Ment. Defic. 76, 1971, 434-439.

CORAH, N. L. and GOSPODINOFF, E. Colour-form and part-whole perception in young children. Child Dev. 37, 1966, 837-843.

CORNWELL, A. C. and BIRCH, H. G. Psychological and social development in home-reared children with Down's Syndrome. Amer. J. Ment. Defic. 74, 1969, 341-350.

CORNWELL, A. C. and BIRCH, H. G. Development of language, abstract and numerical concept formation in Down's Syndrome children. Amer. J. Ment. Defic. 79, 1974, 179-190.

CROLL, W. Children's response alternation as a function of stimulus duration, intertrial interval and trials. Psychonomic Science. 6, 1966, 247-8.

CROSBY, K. G. Attention and distractibility in mentally retarded and intellectually average children. Amer. J. Ment. Defic. 77, 1972, 46-53.

DASHIELL, J. F. Direction orientation in maze running by the white rat. Comp. Psychol. Monogr. 7, 1930.

DEMBER, W. N. Response by the rat to environmental change. J. Comp. Physiol. Psychol. 49, 1956, 93-95.

DEMBER, W. N. Alternation Behaviour, in Fiske, D. W. and Maddi, S. R. (eds). Functions of Varied Experience. Dorsey Press Incorporated. 1961.

DEMBER, W. N., BRODWICK, M. and ROBERTS, W. W. Alternation and exploration in rats with hippocampal lesions. Paper from Eastern Psychol. Ass. New York, April, 1960.

DEMBER, W. N. and EARL, R. W. Analysis of exploratory, manipulatory and curiosity behaviour. Psychol. Rev. 64, 1957, 91-96.

DEMBER, W. N. and FOWLER, H. Spontaneous alternation behaviour. Psychol. Bull. 55, 1958, 412-428.

DEMBER, W. N. and MILLBROOK, B. Free-choice by the rat of the greater of two brightness changes. Psychol. Rep. 2, 1956, 465-467.

DEMBER, W. N. and ROBERTS, W. W. Alternation behaviour in peripherally-blinded rats. Percept. Mot. Skills. 8, 1958, 91-94.

DENNIS, W. A comparison of the rat's first and second explorations of a maze unit. Amer. J. Psychol. 47, 1935, 488-490.

DENNY, M. R. Learning through stimulus satiation. J. Exp. Psychol. 54, 1957, 62-64.

DICKS-MIREAUX, M. J. Mental Development of infants with Down's Syndrome. Amer. J. Ment. Defic. 77, 1972, 26-36.

DOUGLAS, R. Cues for spontaneous alternation. J. Comp. and Physiol. Psychol. 63, 1966, 171-183.

EIMAS, P. D. Components and compounds in discrimination learning of retarded children. J. Exptal. Child Psychol. 1, 1964, 301-310.

ELKIND, D., KOEGLER, R. R. and GO, E. Studies in perceptual development II: part-whole perception. Child Rev. 35, 1964, 81-91.

ELLIS, N. R. Object-quality discrimination learning sets in mental defectives. J. Comp. Physiol. Psychol. 51, 1958, 79-81.

ELLIS, N. R. (ed.). Handbook of Mental Deficiency. New York: McGraw-Hill, 1963, Chapters 1, 3, 4, 5, 8, 12.

ELLIS, N. R. and ARNOULT, M. D. Novelty as a determinant of spontaneous alternation in children. Psychonomic Science. 2, 1965, 163-164.

ELLIS, N. R., GIRARDEAU, F. L. and PRYER, M. V. Analysis of learning sets in normal and severely defective humans. J. Comp. and Physiol. Psychol. 55, 1962, 860-865.

ESTES, W. K. and SCHOEFFLER, M. S. Analysis of variables influencing alternation after forced trials. J. Comp. Physiol. Psychol. 48, 1955, 357-362.

FERNBERGER, S. W. Interdependence of judgements with the series for the method of constant stimuli. J. Exptal. Psychol. 3, 1920, 126-150.

FISHLER, K., SHARE, J. and KOCH, R. Adaptation of Gesell Development Scale for evaluation of development in children with Down's Syndrome. Amer. J. Ment. Defic. 68, 1964, 642-646.

GERJUOY, H. and GERJUOY, I. R. Choice-sequence patterns in binary-choice "learning" by retardates. Amer. J. Ment. Defic. 69, 1964, 425-431.

GERJUOY, I. R. and GERJUOY, H. Binary-choice sequences of retardates, normal children and college students under random- and pattern-set instructions. Amer. J. Ment. Defic. 69, 1965, 854-859.

GERJUOY, I. R. and WINTERS, J. J., JNR. Response preferences and choice-sequence preferences: I. Regression to alternation. Psychonomic Science. 7, 1967, 413-414.

GERJUOY, I. R. and WINTERS, J. J., JNR. Development of lateral and choice-sequence preferences. Internat. Rev. of Research in Ment. Retardation. 3, 1968, 31-63.

GERJUOY, I. R., WINTERS, J. J., JNR. and HOATS, D. L. Alternation in a spatial orientation task. Psychonomic Science. 5, 1966, 83-84.

GIBSON, D. Karyotype variation and behaviour in Down's Syndrome. Amer. J. Ment. Defic. 78, 1973, 128-133.

GIBSON, D. and POZSONYI, J. Morphological and behavioural consequences of chromosome subtype in mongolism. Amer. J. Ment. Defic. 69, 1965, 801-804.

GIRARDEAU, F. L. The formation of discrimination learning sets in mongoloid and normal children. J. Comp. and Physiol. Psychol. 52, 1959, 566-570.

GLANZER, M. The role of stimulus satiation in spontaneous alternation. J. Exptal. Psychol. 45, 1953, 387-393. (b).

GRATCH, G. Response alternation in children: a developmental study of orientations to uncertainty. Vita Humana. 7, 1964, 49-60.

HOUSE, B. J. and ZEAMAN, D. Miniature experiments in the discrimination learning of retardates. In L.P. Lipsitt and C. C. Spiker (eds), Advances in Child Dev. and Behaviour. Vol. 1. New York: Academic Press, 1963.

HUGHES, R. N. Effects of age on novelty reactions and exploration in rats. Quarterly J. Exptal. Psychol. 20, 1968, 189-192. (a).

HULL, C. L. Principles of Behaviour. New York: Appleton-Century-Crofts. 1943.

HUTT, C. Specific and Diverse Exploration. University of Oxford. 1966.

IKEDA, Y. Intellectual development of chromosomal mosaic children with Down's Syndrome. Psych. Abstracts. 52, 1974, 162.

ILLINGWORTH, R. S. The development of the infant and the young child. Livingstone, 1960.

IWAHARA, S. Studies in spontaneous alternation in human studies. III. A developmental study. Jap. Psychol. Res. 1, 1959, 1-8.

IWAHARA, S. and SOEDA, N. The effect of electric shock on spontaneous alternation in the cockroach. Ann. Animal Psychol., Tokyo. 7, 1957, 43-52.

IWAHARA, S. and SUGIMURA, T. Studies in spontaneous alternation in human subjects: II. Effects of stimulus intervals and responding times. Jap. J. Psychol. 30, 1959, 42-47.

JEFFREY, W. E. and COHEN, L. B. Response tendencies of children in two-choice situations. J. Exptal Child Psychol. 2, 1965, 248-254.

KÄÄRIÄINEN, R. and DINGMAN, H. F. The relation of the degree of mongolism to the degree of subnormality. Amer. J. Ment. Defic. 66, 1961, 438-443.

KASS, N. and STEVENSON, H. W. The effect of pretraining reinforcement conditions on learning by normal and retarded children. Amer. J. Ment. Defic. 66, 1961, 76-80.

KESSEN, W. and KESSEN, M. D. Behaviour of young children in a two-choice guessing problem. Child Dev. 32, 1961, 779-788.

KIRKBY, R. J. and LACKLEY, G. H. Spontaneous alternation in mesocrietus accuratus: age differences. Psychonomic Science. 10, 1968, 257-258.

KIVY, P. N., EARL, R. W. and WALKER, E. L. Stimulus context and satiation. J. Comp. Physiol. Psychol. 49, 1956, 90-92.

KLEIN, J. A. and KLEIN, H. A., OSKAMP. L. and PATNODE, G. Colour distractors in discrimination with retarded and nonretarded children. Amer. J. Ment. Defic. 77, 1974, 328-331.

KOUNIN, J. Experimental studies of rigidity. I and II. Charact. Pers. 9, 1941, 251-282.

LAWLESS, R. H. and ENGSTRAND, R. D. Alternation in the human stylus maze. Psychol. Rec. 10, 1960, 101-106.

LEPLEY, W. M. and RICE, G. E. JNR. Behaviour variability in paramecia as a function of guided act sequences. J. Comp. Physiol. Psychol, 45, 1952, 283-286.

LEWIN, K. A. A dynamic theory of personality. New York: McGraw-Hill, 1935.

MAGGS, A. Attention and motivation techniques with the mentally retarded. Aust. J. Ment. Res. 4, 1974, 97-101.

MANLEY, S. and MILLER, F. D. Factors affecting children's alternation and choice behaviours. Psychonomic Science. 13, 1968, 65-66.

MAY, R. B. Stimulus selection in preschool children under conditions of free choice. Percept. Mot. Skills, 16, 1963, 203-206.

MEAD, G. A. Mind, Self and Society. University of Chicago Press, Chicago, 1934.

MEILI-DWORETZKI, G. The development of perception in the Rorschach. In B. Klopfer (ed.). Developments in the Rorschach technique. Vol 2, New York: World Book, 1956.

MENDEL, G. Children's preferences for differing degrees of novelty. Child Dev. 36, 1965, 453-465.

MILES, R. C. Learning in kittens with manipulatory, exploratory and food incentives. J. Comp. Physiol. Psychol. 51, 1958, 39-42.

MILLER, F. D., TU, J. D., MANLEY, S. and MOFFAT, G. H. Children's response alternation as a function of stimulus duration, age and trials. Psychonomic Science. 15, 1969, 199-200.

MISCHEL, H. N. Readings in Personality. New York: Holt, Rinehart and Winston, 1973.

MONTGOMERY, K. C. A test of two explanations of spontaneous alternation. J. Comp. Physiol. Psychol. 45, 1952, 287-293.

MOOR, L. Le Niveau Intellectuel dans le trisomie-21. Psych. Abstracts. 42, 1968, 11065.

O'CONNOR, N. and HERMELIN, B. Shape perception in normal children, mongols and imbeciles. J. Ment. Defic. Res. 5, 1961, 67-71.

PATE, J. and BELL, G. Alternation behaviour of children in a cross maze. Psychonomic Science. 23, 1971, 431-433.

PETERS, R. and PENNEY, R. Spontaneous alternation of high and low reactively curious children. Psychonomic Science. 4, 1966, 139-140.

PETERSON, G. L. The effects of social class and sex on modes of response. Unpublished master's thesis. Louisiana State University, 1970.

PIAGET, J. The Psychology of Intelligence. London: Routledge and Kegan Paul Ltd, 1950.

PIAGET, J. and INHELDER, B. The Child's Conception of Space, F. J. Langdon and J. L. Lunzer (trans.) London: Routledge, 1956.

PLENDERLEITH, M. Discrimination learning and discrimination reversal learning in normal and feeble-minded children. J. Genet. Psychol. 88, 1956, 107-112.

RIEBER, M. Response alternation in children under different schedules of reinforcement. Psychonomic Science. 4, 1966, 149-150.

ROSENCRANS, C. F. The relationship of normal/21 trisomy, mosaicism and intellectual development. Amer. J. Ment. Defic. 72, 1968, 562-565.

SCHAIE, K. W. Developmental changes in response differentiations on a colour arrangement task. J. Consult. Clin. Psychol. 32, 1968, 233-235.

SCHULTZ, D. P. Spontaneous alternation behaviour in humans: implications for psychological research. Psychol. Bull. 62, 1964, 394-400.

SCHUSTERMAN, R. J. Strategies of normal and mentally retarded children under conditions of uncertain outcome. Amer. J. Ment. Defic. 69, 1964, 66-75.

SCHUSTERMAN, R. J. The use of strategies in two-choice behaviour of children and champanzees. J. Comp. Physiol. Psychol. 56, 1963, 96-100.

SCOTT, K. G. Engineering attention: some rules for the classroom. In Education and Training of the Mentally Retarded. 1(3), 1966, 125.

SHARE, J., KOCH, R., WEBB, A. and GRALIKER, B. Longtitudinal development of infants and young children with Down's Syndrome. Amer. J. Ment. Defic. 68, 1964, 685-692.

SHARE, J. and VEALE, A. M. Developmental landmarks for children with Down's Syndrome. University of Otago Press, 1974.

SILVERSTEIN, A. B. Mental growth in mongolism. Child Dev. 37, 1966, 725-728.

SIUDZINSKI, P. M. Testing the House and Zeaman hypothesis with normal and retarded children. Dissertation Abstracts. 27, 1966, 1271A.

SMITH, D.W. and WILSON, A. A. The child with Down's Syndrome. W.B. Saunders and Co., 1973.

SPITZ, H. H. Field theory in mental deficiency. In N. R. Ellis (ed.) Handbook of Mental Deficiency: Psychological theory and research. New York: McGraw-Hill, 1963.

STEVENSON, H. W. and WEIR, M. W. Learning set in children as a function of intellectual and developmental level. Amer. J. Ment. Defic. 65, 1961, 755-757.

STEVENSON, H. W. and ZIGLER, E. F. Discrimination learning and rigidity in normal and feeble-minded individuals. J. Pers. 25, 1957, 699-711.

STRAIN, G. S. Some effects of stimulus oddity on colour choice. Unpublished master's thesis; Purdue University, 1963.

STRAIN, G. S., UNIKEL, P. and ADAMS, H. E. Alternation behaviour by children from lower socio-economic groups. Dev. Psychol. 1, 1969, 131-133.

SUTHERLAND, N. S. Spontaneous alternation and stimulus avoidance. J. Comp. Physiol. Psych. 50, 1957, 358-362.

THOMPSON, M. M. Alternation in the T maze as a function of three variables. Psych. Report. 7, 1960, 103-110.

THOMPSON, M. M. Psychological characteristics relevant to the education of the preschool mongoloid child. Mental Retardation. 1, 1963, 145-152 and 185-187.

TOLMAN, E. C. Purpose and cognition: the determiners of animal learning. Psychol. Rev. 32, 1925, 285-297.

VAN DEN BROEKE, K. Influence of sex, discrimination and intertrial interval on spontaneous alternation in preschoolers. 1975 project.

WALKER, E. L. The duration and course of the reaction decrement and the influence of reward. J. Comp. Physiol. Psychol. 49, 1956, 167-176.

WALKER, E. L. Action decrement and its relation to learning. Psychol. Rev. 65, 1958, 129-142.

WALKER, E. L., DEMBER, W. N., EARL, R. W., FAWL, C. L., and KAROLY, A. J. Choice alternation: III. Response intensity vs. response discriminability. J. Comp. Physiol. Psychol. 48, 1955, 80-85.

WAYNER, M. J., JNR, and ZELLNER, D. K. The role of the supra pharyngeal ganglion in spontaneous alternation and negative movements. Lumbricus Terristris L. J. Comp. Physiol. Psychol. 51, 1958, 282-287.

WEIR, M. W. Developmental changes in problem-solving strategies. Psychol. Rev. 71, 1964, 473-490.

WHITMAN, M. A. Discrimination learning as a function of mental age, intelligence quotient and institutionalization. Dissertation Abstracts. 31, 1971, 907B.

WILCOCK, J. C. and VENABLES, P. M. Dimensional dominance in discrimination learning: a study of severely subnormal and normal subjects. Brit. J. Psychol. 59, 1968, 285-293.

WILLIAMS, J. R. and WILCOCK, J. C. An alternative to the Binet Mental Age Score as a criterion in discrimination learning. J. Ment. Defic. Res. 10, 1966, 27-32.

WINGFIELD, R.C. Some factors influencing spontaneous alternation in human subjects. J. Comp. Psychol. 35, 1943, 237-243.

WINGFIELD, R. C. and DENNIS, W. The dependence of the rat's choice of pathways upon the length of daily trial series. J. Comp. Psychol. 18, 1935, 135-147.

ZEAMAN, D. and ANGELL, D. A. A spatial gradient of alternation tendency. J. Comp. Physiol. Psychol. 46, 1953, 390-392.

ZEAMAN, D. and HOUSE, B. J. Approach and avoidance in discrimination learning of retardates. Child Dev. 33, 1962, 355-372.

ZEKULIN, X. Y., GIBSON, D., MOSLEY, J. L. and BROWN, R. I. Auditory-motor channelling in Down's Syndrome subjects. Amer. J. Ment. Defic. 78, 1974, 571-577.

APPENDIX

RAW DATA

NORMALS
Series I

RAW DATA

TABLE 1 ABCD

		1		2		3		Total
		Cars	Acro-bats	Cars	Acro-bats	Cars	Acro-bats	
♀	1	3	3	3	3	3	3	18
	2	3	3	2	3	2	2	15
	3	3	3	3	2	3	1	15
	4	3	3	2	3	3	2	16
	5	3	3	3	3	3	3	18
	6	3	2	3	3	3	2	16
	7	3	3	3	3	2	3	17
	8	3	3	3	3	3	0	15
	9	3	3	3	3	1	3	16
	10	2	3	3	3	3	1	15
	11	2	3	3	1	1	2	12
	12	2	3	3	3	1	2	14
	13	3	3	3	2	2	3	16
	14	3	3	2	2	3	3	16
	15	3	3	3	3	3	3	18
♂	1	3	3	3	3	2	3	17
	2	3	3	3	3	3	3	18
	3	3	3	3	3	0	3	15
	4	2	2	1	1	3	2	11
	5	2	2	2	1	3	1	11
	6	3	3	3	3	0	3	15
	7	3	3	3	3	3	2	17
	8	3	3	3	3	3	0	15
	9	3	3	3	3	3	1	16
	10	3	3	3	3	2	1	15
	11	3	3	3	3	3	3	18
	12	3	3	3	3	3	2	17
	13	3	3	3	1	2	3	15
	14	3	3	3	2	3	0	14
	15	3	3	3	3	2	3	17

MONGOLS
Series I

RAW DATA

TABLE 1 ABCD

		1		2		3		Total
		Cars	Acro-bats	Cars	Acro-bats	Cars	Acro-bats	
♀	1	3	3	3	3	3	3	17
	2	2	3	3	3	3	1	15
	3	1	3	3	2	2	2	13
	4	2	3	3	3	3	2	16
	5	2	3	2	3	3	3	16
	6	3	3	2	3	3	3	17
	7	3	3	3	3	3	2	17
	8	1	3	3	2	3	3	15
	9	0	2	2	3	2	1	10
	10	3	3	2	3	3	3	17
	11	3	2	3	3	3	3	17
	12	3	2	2	2	2	3	14
	13	3	3	3	3	2	3	17
	14	2	3	2	2	3	3	15
	15	2	3	3	3	2	3	17
♂	1	3	3	3	3	3	2	17
	2	3	3	3	3	3	3	18
	3	3	2	3	3	2	2	15
	4	3	3	3	3	3	3	18
	5	3	3	3	2	2	2	15
	6	3	3	2	3	2	2	15
	7	3	3	2	3	3	3	17
	8	2	3	3	3	3	3	17
	9	1	2	3	3	2	3	14
	10	3	2	3	3	3	3	17
	11	2	2	3	3	3	2	15
	12	1	2	2	2	3	3	13
	13	3	3	3	3	3	2	17
	14	3	3	3	3	3	3	18
	15	3	3	2	3	3	3	17

MONGOLS
Series II

RAW DATA

TABLE 1 ABCD

		1		2		3		Total
		Cars	Acro-bats	Cars	Acro-bats	Cars	Acro-bats	
	1	3	3	3	3	3	3	18
	2	2	3	3	3	2	3	16
	3	1	3	3	2	3	2	14
	4	2	3	3	3	3	3	17
	5	2	3	2	3	3	3	16
	6	3	3	2	3	3	1	15
	7	3	3	3	3	2	3	17
♀	8	1	3	3	2	3	2	14
	9	0	2	2	3	3	2	12
	10	3	3	2	3	2	3	16
	11	3	2	3	3	3	3	17
	12	3	2	2	2	3	2	15
	13	3	3	3	3	3	3	18
	14	2	3	2	2	3	3	15
	15	3	3	3	3	3	2	17
	1	3	3	3	3	1	3	10
	2	3	3	3	3	3	3	18
	3	3	2	3	3	2	1	14
	4	3	3	3	3	0	2	14
	5	3	3	3	2	2	3	16
	6	3	3	2	3	3	2	16
♂	7	3	3	2	3	3	3	17
	8	2	3	3	3	3	3	17
	9	1	2	3	3	2	3	14
	10	3	2	3	3	3	3	17
	11	2	2	3	3	2	2	14
	12	1	2	2	2	3	2	12
	13	3	3	3	3	3	2	17
	14	3	3	3	3	3	3	18
	15	3	3	2	3	3	3	17

NORMALS
Series II

RAW DATA

TABLE 1 ABCD

		1		2		3		Total
		Cars	Acro-bats	Cars	Acro-bats	Cars	Acro-bats	
♀	1	3	3	3	3	2	3	17
	2	3	3	2	3	2	0	13
	3	3	3	3	2	3	3	17
	4	3	3	2	3	1	3	15
	5	3	3	3	3	3	3	18
	6							
	7	3	3	3	3	3	3	18
	8	3	3	3	3	2	3	17
	9							
	10							
	11							
	12	2	3	3	3	2	3	16
	13	3	3	3	2	3	3	17
	14							
	15							
♂	1	3	3	3	3	3	3	18
	2	3	3	3	3	2	3	17
	3							
	4	2	2	1	1	1	3	10
	5							
	6							
	7							
	8	3	3	3	3	3	0	15
	9	3	3	3	3	1	3	16
	10	3	3	3	3	2	1	15
	11	3	3	3	3	3	3	18
	12	3	3	3	3	2	2	16
	13	3	3	3	1	3	3	16
	14	3	3	3	2	2	2	15
	15	3	3	3	3	3	3	18